#15 WM 10/21/03

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of: Thomas RUNKLER et al.	RECEIVED OCT 07 2003
Application No.: 09/553,956	Group Art Unit: 2172 Technology Center 2100
Filed: April 21, 2000	Examiner: Pham, H.
Attorney Docket: 50277-0452 Client Docket: OID-1999-038-01	

For: SYSTEM AND METHOD FOR GENERATING DECISION TREES

APPEAL BRIEF

Honorable Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

This Appeal Brief is submitted, in triplicate, in support of the Notice of Appeal filed July 28, 2003.

I. REAL PARTY IN INTEREST

Siemens and Oracle International Corp. are the real parties in interest.

II. RELATED APPEALS AND INTERFERENCES

Appellants are unaware of any related appeals and interferences.

III. STATUS OF THE CLAIMS

Claims 1-8, 10, 12-25, 27, and 29-34 are pending in this appeal, in which claims 9, 11, 26, and 28 have earlier been canceled. No claim is allowed. This appeal is therefore taken from the final rejection of claims 1-8, 10, 12-25, 27, and 29-34 on March 25, 2003.

IV. STATUS OF AMENDMENTS

The Advisory Action dated July 8, 2003, indicates that the amendment to claims 1, 9-11, 18, and 26-28 filed June 25, 2003 has been entered.

V. SUMMARY OF THE INVENTION

The present invention addresses problems associated with data analysis of large databases and more particularly with generating decision trees that represents the extraction of useful information from vast amounts of accumulated data. For example, pharmaceutical companies have large databases listing drug compounds and their features and would like to analyze this data to ascertain useful patterns, such as determining what group of drugs are effective in treating each of a group of diseases, especially when the desired groupings of drugs and diseases are not identified beforehand. Many data mining techniques use pattern recognition and probabilistic analyses to generate a decision tree, which is a data structure that contains a hierarchical arrangement of rules that successively classifies an object, characterized by various attributes, into an appropriate category of many using rule in the decision tree tests the value of one attribute at a time. For example, the characteristics of a drug compound and its effective methods of administration in treating a particular disease can be translated into a set of rules based on a patient's symptoms. (Specification, p. 1)

One problem with many decision trees is rigidity of classification. In the drug effectiveness example, some decision trees impose an "either-or" or binary approach to the data, even though different drugs have varying degrees of effectiveness. Due to the imprecision of the real world data values close to the border of a crisp range in a decision tree are apt to be misclassified. As a result, there has been a number of attempts to apply the concepts of "fuzzy logic" to decision trees by using fuzzy logic, which allows an object to be part-time members of different classes. (Specification, p. 3) Some attempts to incorporate fuzzy logic in building decisions trees are cumbersome and may require substantial research to use properly, so, prior to the present invention, there has been a need for a data analysis technique that can work with fuzzy data but that does not require groupings or other *a priori* data to be supplied beforehand. (Specification, p. 5)

Various aspects of the present invention addresses these and other needs in the data analysis art, for example, by dynamically and fuzzily clustering data on the fly while the decision tree is being generated, without requiring the use to predefine sets or pre-calculate fuzzy membership functions. (Specification, p. 5) This is reflected in claim 1, whose elements are read on corresponding portions of the disclosure:" 1. A method for refining a node (410) of a decision tree associated with a plurality of data (300) characterized by a plurality of features (X, Y), comprising: selecting (204) a feature (X as L^*) from among the features (X, Y) characterizing the data (300) associated with the node (410); performing a cluster analysis (206) along the selected feature (X as L^*) to group the data (300) into one or more clusters (310+320, 330, 340); constructing (208) one or more arcs (412, 413, 414) of the decision tree at the node (410) respectively for each of the one or more clusters; and projecting the data in each of the clusters (310+320, 330, 340), wherein the projected data are characterized by the plurality of the features

but for the selected feature (Y not X); and recursively performing (212) the steps of selecting (204) a feature (Y) and performing (206) the cluster analysis on the projected data in each of the clusters (e.g. 310+320)." Other claims relates to specific way of facilitating this process including the use of a domain ratio and partition coefficients.

VI. ISSUES

Whether claims 1-5, 9-13, 16-22, 26-30, and 33-24 are obvious under 35 U.S.C. § 103 based on *Hall et al.* (Hall et al., "Generating Fuzzy Rules from Data," *IEEE*, 1996)?

Whether claims 6, 14, 23, and 31 are obvious over *Hall et al.* in view of *Shafer et al.* (Shafer et al., "SPRINT: A Scalable Parallel Classifier for Data Mining," *Proceedings of the 22nd VLDB Conference*, 1996)?

Whether claims 7-8, 15, 24-25, and 32 as obvious over *Hall et al.* in view of *Choe et al.* (Choe et al., "On the Optimal Choice of Parameters in a Fuzzy C-Means Algorithm," *IEEE*, 1992)?

VII. GROUPING OF CLAIMS

The claims should not be regarded as all standing together since the claims recite respective limitations that render each of the claims separately patentable. For the purposes of this appeal, the following groups are recognized:

A. Claims 1-2, 4-5, 18-19, and 21-22

B. Claims 3 and 20

C. Claims 6, 14, 23, and 31

D. Claims 7-8, 15, 24-25, and 32

E. Claims 9, 11, 26, and 28

F. Claims 10, 12-13, 16-17, 26, 27, 29-30, and 33-24

VIII. ARGUMENT

A. CLAIMS 1-8 AND 18-25 ARE NOT RENDERED OBVIOUS BECAUSE THE APPLIED REFERENCES FAIL TO TEACH "RECURSIVELY ... PERFORMING THE CLUSTER ANALYSIS ON THE PROJECTED DATA IN EACH OF THE CLUSTERS."

The initial burden of establishing a *prima facie* basis to deny patentability to a claimed invention under any statutory provision always rests upon the Examiner. *In re Mayne*, 41 USPQ2d 1451 (Fed .Cir. 1997); *In re Deuel*, 34 USPQ2d 1210 (Fed. Cir. 1995); *In re Bell*, 26 USPQ2d 1529 (Fed. Cir. 1993); *In re Oetiker*, 24 USPQ2d 1443 (Fed. Cir. 1992). In rejecting a claim under 35 U.S.C. § 103, the Examiner is required to provide a factual basis to support the obviousness conclusion. *In re Warner*, 154 USPQ 173 (CCPA 1967); *In re Lunsford*, 148 USPQ 721 (CCPA 1966); *In re Freed*, 165 USPQ 570 (CCPA 1970). The Examiner is required to show that all the claim limitations are taught or suggested by the references. *In re Royka*, 180 USPQ 580 (CCPA 1974); *In re Wilson*, 165 USPQ 494 (CCPA 1970).

Reversal of the rejection of claims 1-8 and 18-25 is respectfully requested because *Hall et al.*, individually or in combination with *Shafer et al.* and *Choe et al.*, faisl to teach or otherwise the features of the claims. For example, independent method claim 1 (whose limitations are mirrored in independent computer-readable medium claim 18) sets forth:

> 1. A method for refining a node of a decision tree associated with a plurality of data characterized by a plurality of features, comprising:
> selecting a feature from among the features characterizing the data associated with the node;
> performing a cluster analysis along the selected feature to group the data into one or more clusters;
> constructing one or more arcs of the decision tree at the node respectively for each of the one or more clusters; and

projecting the data in each of the clusters, wherein the projected data are characterized by the plurality of the features but for the selected feature; and

recursively performing the steps of selecting a feature and **performing the cluster analysis on the projected data in each of the clusters**.

Accordingly, independent claims 1 and 18 recites a way of refining a node in a decision tree by selecting a feature of those that characterize the data associated with the node, then performing a cluster analysis along the selected feature, and then constructing arcs of the decision tree for each of the clusters. Furthermore, the claims recite "recursively ... performing the cluster analysis on the projected data in each of the clusters." Thus, another cluster analysis is recursively performed on projected data in each of the clusters, enabling the decision to be built "on the fly" (see Spec., p. 6), rather than relying on pre-analyzed clusters.

By contrast, *Hall et al.* merely relates to a technique for generating pre-analyzed clusters for use in a conventional decision tree building algorithm. *Hall et al.* is directed to a method of developing of fuzzy rules from continuous valued data by building a decision tree in accordance with the C4.5 algorithm (Abstract, p. 1757, col. 1). However, *Hall et al.* recognizes that the "C4.5 algorithm tree algorithm **requires crisp** class assignments for all objects. It is **necessary** to partition the continuous output values into a effect set of **discrete** output classes." (Section 2.1, p. 1758, col. 1, emphasis added). *Hall et al.* thus proposes to preprocess the data initially by applying a fuzzy c-means clustering to determine the discrete classes, and then feeding the discrete classes into the C4.5 algorithm: "After a discrete class has been created for each example, as discussed in Section 2.1, C4.5 may be used to create a decision tree." (Section 3, p. 1759, col. 1). Therefore, whatever cluster analysis performed in *Hall et al.*, that cluster analysis must be performed **before**, not during, the building of the decision tree with the C4.5 algorithm.

As a result, there is no teaching or suggesting in *Hall et al.*, of recursively performing the cluster analysis while "refining a node of a decision tree."

This lack of teaching is reason enough that there is not a factual basis to sustain the Examiner's rejection. In fact, what little disclosure of *Hall et al.*'s clustering method happens to **teach against** the recursively cluster analysis of the claims. *Hall et al.*'s C.4.5 algorithm requires crisp classes, and, if the classes are crisp at the beginning of the C4.5 algorithm, no cluster analysis during execution of the C4.5 algorithm would be necessary, teaching against "recursively ... performing the cluster analysis on the projected data in each of the clusters" in a method for "refining a node of a decision tree." Indeed, obviousness rejections require some evidence in the prior art of a teaching, motivation, or suggestion to combine and modify the prior art references. See, e.g., *McGinley v. Franklin Sports, Inc.*, 262 F.3d 1339, 1351-52, 60 USPQ2d 1001, 1008 (Fed. Cir. 2001); *Brown & Williamson Tobacco Corp. v. Philip Morris Inc.*, 229 F.3d 1120, 1124-25, 56 USPQ2d 1456, 1459 (Fed. Cir. 2000); *In re Dembiczak*, 175 F.3d 994, 999, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999). A prior art reference must be considered in this entirety including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.,* 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984)

The remaining portions of *Hall et al.* cited in the Office Action (viz. FIG. 1 and pp. 1757-1758) merely show a decision tree without any suggestion of the recursively performed cluster analysis. The remaining references, *Shafer et al.* and *Choe et al.*, also fail to teach this aspect of claims 1-9 and 18-26, and the Examiner properly did not attempt to rely on these references for disclosure of this element.

B. CLAIMS 7-8, 15, 24-25, AND 32 ARE NONOBVIOUS OVER *HALL ET AL.* AND *CHOE ET AL.* BECAUSE NEITHER TEACHES NOR SUGGESTS THE "DOMAIN RATIO" DEFINED IN THE CLAIMS.

Reversal is also proper for the rejection of claims 7-8, 15, 24-25, and 32 which cover the element of "calculating a domain **ratio** of a difference in domains limits of the data **over** a difference in domain limits of a superset of the data." As recited, the domain ratio is explicitly a ratio of one difference over another different.

The Examiner correctly recognized that *Hall et al.* fails to disclose this element, but mistakenly relied on *Choe et al.* for this feature. Specifically, the Examiner cites step 6 of *Choe et al.*'s algorithm, which states: "return to Step 3 if $\| U^{(l+1)} - U^{(l)} \| > \varepsilon$."[1] However, this condition is a **difference** of two quantities, $U^{(l+1)}$ and $U^{(l)}$, not a ratio of two differences as recited in claims 7-8, 15, 24-25, and 32. Furthermore, the U in *Choe et al.* is a "fuzzy c-partition of X," not the domain limit as specified in these claims.

In response, the Examiner asserted that "instead of the different [*sic*] between two consecutive U, a domain ratio could be used and still give the same result." This is a frank admission that both *Hall et al.* and *Choe et al.* fail to teach the limitations of claims 7-8, 15, 24-25, and 32, since these claims specifically require a "domain **ratio**." In rejecting a claim under 35 U.S.C. § 103, the Examiner is required to provide a factual basis to support the obviousness conclusion. *In re Warner*, 154 USPQ 173 (CCPA 1967); *In re Lunsford*, 148 USPQ 721 (CCPA 1966); *In re Freed*, 165 USPQ 570 (CCPA 1970). The Examiner is required to show that all the claim limitations are taught or suggested by the references. *In re Royka*, 180 USPQ 580 (CCPA 1974); *In re Wilson*, 165 USPQ 494 (CCPA 1970). Neither *Hall et al.* nor *Choe et al.* teach or

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[1] Due to typographical limitations of the Appellant's word processor, the "not less than or equal to" symbol (≤ with a stroke through it) of *Choe et al.* is replaced by the equivalent "greater than" (>) symbol.

suggest the recited "domain ratio," and there is nothing else in the record to furnish the requisite factual basis to support the obviousness rejection.

C. CLAIMS 3, 10, 12-17, 20, 27, AND 29-34 ARE PATENTABLE OVER THE APPLIED REFERENCES BECAUSE NONE OF THEM TEACH A "PARTITION COEFFICIENT."

The rejections of claims 3, 10, 12-17, 20, 27, and 29-34 is improper and should be reversed because *Hall et al.*, alone or in combination with *Shafer et al.* and *Choe et al.*, fail to teach or suggest the limitations of claims 3, 10, 12-17, 20, 27, and 29-34, for example using a "partition coefficient" to select one of the features.

As explained above, *Hall et al.* discloses a method of generating fuzzy rules from data by first performing a fuzzy cluster analysis to determine crisp, discrete classes for the data and then applying the C4.5 decision tree algorithm to the discrete classes. Since the C4.5 decision tree algorithm requires discrete classes, the C4.5 algorithms selects its features to build the decision tree based on the "highest information gain associated with it" (Section 2, p. 1758, col. 1). Although *Hall et al.* fails to give any details about how to calculated an "information gain," which, by itself, is deficiently in establishing a factual basis for the recited "partition coefficient," the specification of the present application explains on p. 3, line 17, that the "information is calculated by finding the average entropy of each attribute." However, average entropy is not a partition coefficient.

The Office Action contention that "the maximum information gain is chosen among the calculated information gain ratio as the partition coefficient" does not support the rejection because an information gain is not the same thing as a partition coefficient–as those terms are understood by one of skill in the art. Well-settled case law holds that the words of a claim must be read as they would be interpreted by those of ordinary skill in the art. *In re Baker Hughes Inc.*,

215 F.3d 1297, 55 USPQ2d 1149 (Fed. Cir. 2000); *In re Morris*, 127 F.3d 1048, 1054, 44 USPQ2d 1023, 1027 (Fed. Cir. 1997); M.P.E.P. 2111.01. "Although the PTO must give claims their broadest reasonable interpretation, this interpretation must be consistent with the one that those skilled in the art would reach." *In re Cortright,* 165 F.3d 1353, 1369, 49 USPQ2d 1464, 1465 (Fed. Cir. 1999). Therefore, the rejection cannot be salvaged by redefining a "partition coefficient" as information gain, when "partition coefficient" already has a definite meaning that is not an information gain.

Sensing the weakness of the Examiner's rejection, the Advisory Action dated July 8, 2003, contended that a "partition coefficient" is defined in the specification in such as a way as to read on an information gain, latching onto a statement in the Specification, p. 15:3-5, which is: "a partition coefficient, which quantifies the goodness of the clustering." The Examiner's position appears to be that the non-restrictive relative clause "which quantifies the goodness of the clustering" overrides the ordinary meaning of a partition coefficient (see, e.g. Equation (5) on page 15).

The Examiner's logic is contrary to the plain meaning of the relative clause and contradicts well-settled principles of claim interpretation. First, non-restricted relative clauses merely give a property or genus of a term and are not usually taken to be an exclusive definition. For example, the phrase, "a dog, which is a mammal," does not mean that a dog is a cat, but that it is the Examiner's logic. Second, the Examiner's proposed redefinition in such as a way as to read on non-partition coefficients, such as an information gain, ignores the principle that claims must be read as a whole, and it is improper to ignore qualifiers in the claim terms such as "partition." See *Apple Computer, Inc. v. Articulate Systems, Inc.*, 234 F.3d 14 (Fed. Cir. 2000) (holding that the district court "cannot read the qualifier 'help' out the definition of 'help access window'" of claim 2).

As far as the other phrase grasped by the Examiner, "how well separated the clusters are," there is no basis in the record or elsewhere that the information gain measures "how well separated the clusters are." Rather, information gain relates to average entropy of information, which measures something other than cluster separation such as that increases in cluster separation need not result in improved information gain.

The remaining references, *Shafer et al.* and *Choe et al.*, also fail to teach this aspect of claims 3, 10, 12-17, 20, 27, and 29-34 and were not cited for that purpose.

IX. CONCLUSION AND PRAYER FOR RELIEF

Appellants, therefore, request the Honorable Board to reverse each of the Examiner's rejections.

Respectfully Submitted,

DITTHAVONG & CARLSON, P.C.

9/29/2003
Date

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APPENDIX

1. A method for refining a node of a decision tree associated with a plurality of data characterized by a plurality of features, comprising:

selecting a feature from among the features characterizing the data associated with the node;

performing a cluster analysis along the selected feature to group the data into one or more clusters;

constructing one or more arcs of the decision tree at the node respectively for each of the one or more clusters;

projecting the data in each of the clusters, wherein the projected data are characterized by the plurality of the features but for the selected feature; and

recursively performing the steps of selecting a feature and performing the cluster analysis on the projected data in each of the clusters.

2. The method according to claim 1, wherein the step of selecting the feature includes the steps of:

performing a plurality of cluster analyses along each of the features to calculate a maximal cluster validity measure, said maximal cluster validity measure corresponding to one of the features; and

selecting the one of the features that corresponds to the maximal cluster validity measure.

3. The method according to claim 2, wherein the step of performing a plurality of cluster analyses along each of the features to calculate a maximal cluster validity measure includes the performing the steps of:

for each of the features, performing a plurality of cluster analyses along said each of the features for a plurality of cluster numbers to calculate respective partition coefficients; and

determining the maximal cluster validity measure from among the partition coefficients.

4. The method according to claim 1, wherein the step of performing the cluster analysis includes the step of performing a fuzzy cluster analysis.

5. The method according to claim 4, wherein the step of performing the fuzzy cluster analysis includes the step of performing a fuzzy c-means analysis.

6. The method according to claim 1, wherein the step of performing the cluster analysis includes the step of performing a hard cluster analysis.

7. The method according to claim 1, wherein the step of performing the cluster analysis along the selected feature to group the data into one or more clusters includes the steps of:

calculating a domain ratio of a difference in domains limits of the data over a difference in domain limits of a superset of the data;

determining whether the domain ratio has a predetermined relationship with a predetermined threshold; and

if the domain ratio has the predetermined relationship with the predetermined threshold, then grouping the data into a single cluster.

8. The method according to claim 7, wherein the step of determining whether the domain ratio has the predetermined relationship with the predetermined threshold includes the step of determining whether the domain ratio is less than the predetermined threshold.

9. (Canceled)

10. A method for generating a decision tree for a plurality of data characterized by a plurality of features, comprising:

performing a plurality of cluster analyses along each of the features to calculate a maximal cluster validity measure, said maximal cluster validity measure corresponding to one of the features;

selecting the one of the features corresponding to the maximal cluster validity measure;

subdividing the data into one or more groups based on the selected feature; and

building the decision tree based on the one or more groups,

wherein the step of performing the cluster analyses along each of the features to calculate a maximal cluster validity measure includes the performing the steps of:

for each of the features, performing a plurality of cluster analyses along said each of the features for a plurality of cluster numbers to calculate respective partition coefficients; and

determining the maximal cluster validity measure from among the partition coefficients.

11. (Canceled)

12. The method according to claim 10, wherein the step of performing the cluster analyses includes the step of performing a plurality of fuzzy cluster analyses.

13. The method according to claim 10, wherein the step of performing the fuzzy cluster analyses includes the step of performing a plurality of fuzzy c-means analyses.

14. The method according to claim 10, wherein the step of performing the cluster analyses includes the step of performing a plurality of hard cluster analyses.

15. The method according to claim 10, wherein the step of performing the cluster analyses includes the steps of:

calculating a domain ratio of a difference in domains limits of the data over a difference in domain limits of a superset of the data;

determining whether the domain ratio has a predetermined relationship with a predetermined threshold; and

if the domain ratio has the predetermined relationship with the predetermined threshold, then grouping the data into a single cluster.

16. The method according to claim 10, wherein building the decision tree based on the one or more groups includes the steps of:

projecting the data in each of the groups, wherein the projected data are characterized by the plurality of the features but for the selected feature; and

recursively performing the steps of selecting a feature, comprising selecting a new one of the features corresponding to a new maximal partition coefficient and subdividing the data into one or more new groups based on the selected new feature.

17. A method for generating a decision tree for a plurality of data characterized by a plurality of features, comprising:

performing a plurality of fuzzy cluster analyses along each of the features to calculate a maximal partition coefficient and a corresponding set of one or more fuzzy clusters, said maximal partition coefficient corresponding to one of the features;

selecting the one of the features corresponding to the maximal partition coefficient; and

building the decision tree based on the corresponding set of one or more fuzzy clusters.

18. A computer-readable medium bearing instructions for refining a node of a decision tree associated with a plurality of data characterized by a plurality of features, said instructions being arranged to cause one or more processors upon execution thereby to perform the steps of:

selecting a feature from among the features characterizing the data associated with the node;

performing a cluster analysis along the selected feature to group the data into one or more clusters;

constructing one or more arcs of the decision tree at the node respectively for each of the one or more clusters;

projecting the data in each of the clusters, wherein the projected data are characterized by the plurality of the features but for the selected feature; and

recursively performing the steps of selecting a feature and performing the cluster analysis on the projected data in each of the clusters.

19. The computer-readable medium according to claim 18, wherein the step of selecting the feature includes the steps of:

performing a plurality of cluster analyses along each of the features to calculate a maximal cluster validity measure, said maximal cluster validity measure corresponding to one of the features; and

selecting the one of the features that corresponds to the maximal cluster validity measure.

20. The computer-readable medium according to claim 19, wherein the step of performing a plurality of cluster analyses along each of the features to calculate a maximal cluster validity measure includes the performing the steps of:

for each of the features, performing a plurality of cluster analyses along said each of the features for a plurality of cluster numbers to calculate respective partition coefficients; and

determining the maximal cluster validity measure from among the partition coefficients.

21. The computer-readable medium according to claim 18, wherein the step of performing the cluster analysis includes the step of performing a fuzzy cluster analysis.

22. The computer-readable medium according to claim 21, wherein the step of performing the fuzzy cluster analysis includes the step of performing a fuzzy c-means analysis.

23. The computer-readable medium according to claim 18, wherein the step of performing the cluster analysis includes the step of performing a hard cluster analysis.

24. The computer-readable medium according to claim 18, wherein the step of performing the cluster analysis along the selected feature to group the data into one or more clusters includes the steps of:

calculating a domain ratio of a difference in domains limits of the data over a difference in domain limits of a superset of the data;

determining whether the domain ratio has a predetermined relationship with a predetermined threshold; and

if the domain ratio has the predetermined relationship with the predetermined threshold, then grouping the data into a single cluster.

25. The computer-readable medium according to claim 24, wherein the step of determining whether the domain ratio has the predetermined relationship with the predetermined threshold includes the step of determining whether the domain ratio is less than the predetermined threshold.

26. (Canceled)

27. A computer-readable medium bearing instructions for generating a decision tree for a plurality of data characterized by a plurality of features, said instructions being arranged to cause one or more processors upon execution thereby to perform the steps of:

performing a plurality of cluster analyses along each of the features to calculate a maximal cluster validity measure, said maximal cluster validity measure corresponding to one of the features;

selecting the one of the features corresponding to the maximal cluster validity measure;

subdividing the data into one or more groups based on the selected feature; and

building the decision tree based on the one or more groups,

wherein the step of performing the cluster analyses along each of the features to calculate a maximal cluster validity measure includes the performing the steps of:

for each of the features, performing a plurality of cluster analyses along said each of the features for a plurality of cluster numbers to calculate respective partition coefficients; and

determining the maximal cluster validity measure from among the partition coefficients.

28. (Canceled)

29. The computer-readable medium according to claim 27, wherein the step of performing the cluster analyses includes the step of performing a plurality of fuzzy cluster analyses.

30. The computer-readable medium according to claim 27, wherein the step of performing the fuzzy cluster analyses includes the step of performing a plurality of fuzzy c-means analyses.

31. The computer-readable medium according to claim 27, wherein the step of performing the cluster analyses includes the step of performing a plurality of hard cluster analyses.

32. The computer-readable medium according to claim 27, wherein the step of performing the cluster analyses includes the steps of:

calculating a domain ratio of a difference in domains limits of the data over a difference in domain limits of a superset of the data;

determining whether the domain ratio has a predetermined relationship with a predetermined threshold; and

if the domain ratio has the predetermined relationship with the predetermined threshold, then grouping the data into a single cluster.

33. The computer-readable medium according to claim 27, wherein building the decision tree based on the one or more groups includes the steps of:

projecting the data in each of the groups, wherein the projected data are characterized by the plurality of the features but for the selected feature; and

recursively performing the steps of selecting a feature, comprising selecting a new one of the features corresponding to a new maximal partition coefficient and subdividing the data into one or more new groups based on the selected new feature.

34. A computer-readable medium bearing instructions for generating a decision tree for a plurality of data characterized by a plurality of features, said instructions being arranged to cause one or more processors upon execution thereby to perform the steps of:

performing a plurality of fuzzy cluster analyses along each of the features to calculate a maximal partition coefficient and a corresponding set of one or more fuzzy clusters, said maximal partition coefficient corresponding to one of the features;

selecting the one of the features corresponding to the maximal partition coefficient; and

building the decision tree based on the corresponding set of one or more fuzzy clusters.

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# TRANSMITTAL FORM *(to be used for all correspondence after initial filing)*	Application Number	09/553,956
	Filing Date	April 21, 2000
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	Attorney Docket Number	50277-0452
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ENCLOSURES *(check all that apply)*

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☐ Amendment / Response	☐ Licensing-related Papers	☐ Appeal Communication to Group *(Appeal Notice, Brief, Reply Brief)*
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SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm *or* Individual name	DITTHAVONG & CARLSON, P.C. Stephen C. Carlson, Reg. No. 39929
Signature	
Date	September 29, 2003

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FEE TRANSMITTAL for FY 2003

Effective 01/01/2003. Patent fees are subject to annual revision.

☐ Applicant Claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 820.00

Complete if Known	
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METHOD OF PAYMENT *(check all that apply)*

☐ Check ☒ Credit card ☐ Money Order ☐ Other ☐ None

☐ Deposit Account

Deposit Account Number:

Deposit Account Name:

The Commissioner is authorized to: *(check all that apply)*

☒ Charge fee(s) indicated below ☐ Credit any overpayments

☐ Charge any additional fee(s) during the pendency of this application

☐ Charge fee(s) indicated below, **except for the filing fee**

to the above-identified deposit account.

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1001	750	2001	375	Utility filing fee	
1002	330	2002	165	Design filing fee	
1003	520	2003	260	Plant filing fee	
1004	750	2004	375	Reissue filing fee	
1005	160	2005	80	Provisional filing fee	

SUBTOTAL (1) ($)

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

			Extra Claims		Fee from below		Fee Paid
Total Claims		-20**=		X		=	
Independent Claims		- 3**=		X		=	
Multiple Dependent						=	

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
1202	18	2202	9	Claims in excess of 20
1201	84	2201	42	Independent claims in excess of 3
1203	280	2203	140	Multiple dependent claim, if not paid
1204	84	2204	42	**Reissue independent claims over original patent
1205	18	2205	9	**Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($)

*** or number previously paid, if greater; For Reissues, see above*

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge – late filing fee or oath	
1052	50	2052	25	Surcharge – late provisional filing fee or cover sheet	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for *ex parte* reexamination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	110	2251	55	Extension for reply within first month	
1252	410	2252	205	Extension for reply within second month	
1253	930	2253	465	Extension for reply within third month	
1254	1,450	2254	725	Extension for reply within fourth month	
1255	1,970	2255	985	Extension for reply within fifth month	
1401	320	2401	160	Notice of Appeal	
1402	320	2402	160	Filing a brief in support of an appeal	320.00
1403	280	2403	140	Request for oral hearing	
1451	1,510	1451	1,510	Petition to institute a public use proceeding	
1452	110	2452	55	Petition to revive – unavoidable	
1453	1,300	2453	650	Petition to revive – unintentional	
1501	1,300	2501	650	Utility issue fee (or reissue)	
1502	470	2502	235	Design issue fee	
1503	630	2503	315	Plant issue fee	
1460	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17(q)	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	750	2809	375	Filing a submission after final rejection (37 CFR § 1.129(a))	
1810	750	2810	375	For each additional invention to be examined (37 CFR § 1.129(b))	
1801	750	2801	375	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited examination of a design application	

Other fee (specify) ____________

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($) 320

SUBMITTED BY				Complete *(if applicable)*	
Name (Print/Type)	Stephen C. Carlson	*Registration No. (Attorney/Agent)*	39929	*Telephone*	703-425-8516
Signature	[signature]			*Date*	September 29, 2003

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